Section II (Remarks)

A. Summary of Amendment to the Specification

By the present Amendment, paragraph [0083] has been amended to correct a typographical error in the first sentence thereof. No new matter has been introduced by the foregoing amendment.

B. Response to Claim Rejections Under 35 U.S.C. 103

The April 9, 2008 Office Action included multiple rejections under 35 U.S.C. 103(a), including:

- a rejection of claims 1, 10, 16-25, 27, and 28 as being unpatentable for obviousness over U.S. Patent No. 6,534,033 to Amendola et al. ("Amendola") in view of U.S. Patent No. 6,228,146 to Kuespert ("Kuespert"), and further in view of U.S. Patent No. 5,876,604 to Nemser et al. ("Nemser"); and
- a rejection of claims 29, 30, 49, and 50 as being unpatentable for obviousness over Amendola, Kuespert, and Nemser, and further in view of U.S. Patent Application Publication No. 2001/0045364 to Hockaday, et al. ("Hockaday").

Such rejections are traversed for the reasons stated below.

1. Law Regarding Obviousness Rejections

To support a rejection under 35 U.S.C. 103, **the prior art reference(s) must teach all of the limitations of the claims**. MPEP § 2143.03.

In considering a reference for its effect on patentability, the reference is required to be considered in its entirety, including portions that **teach away** from the invention under consideration. Simply stated, the prior art must be considered as a whole. *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984) (emphasis added); MPEP § 2141.02. "It is impermissible within the framework of section 103 to pick and choose from any one reference only so much of it as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art." *Application of Wesslau*, 353 F.2d 238, 241 (C.C.P.A. 1965); *Bausch & Lomb, Inc. v. Barnes-Hind/Hydrocurve*, 796 F.2d 443, 448 (Fed. Cir. 1986), cert. denied, 484 U.S. 823 (1987). The Federal Circuit and its predecessor court have repeatedly held that **if references taken in combination would produce a**

'seemingly inoperative' device, then such references teach away from the combination and cannot serve as predicates for a *prima facie* case of obviousness. *McGinley v. Franklin Sports, Inc.*, 262 F.3d 1339, 60 USPQ2d 1001, 1010 (Fed. Cir. 2001); *Tec Air, Inc. v. Denso Mfg. Mich. Inc.*, 192 F.3d 1353, 52 USPQ2d 1294, 1298 (Fed. Cir. 1999) (proposed combination of references that would be inoperable for intended purpose supports teaching away from combination); *In re Gordon*, 733 F.2d 900, 902, 221 USPQ 1125, 1127 (Fed. Cir. 1984) (inoperable modification teaches away); *In re Sponnoble*, 405 F.2d 578, 587, 160 USPQ 237, 244 (C.C.P.A. 1969) (references teach away from combination if combination produces seemingly inoperative device).

According to the U.S. Supreme Court decision in *KSR International Co. v. Teleflex Inc.*, 127 S.Ct 1727, 167 L.Ed.2d 705, 82 USPQ2d 1385 (April 30, 2007), the court did not disavow the previous "teaching, motivation or suggestion" or "TSM" test, but stated that such TSM text *should not be strictly applied* in determining obviousness. In connection with this point, the Supreme Court stated that:

> "**A patent composed of several elements is not proved obvious merely by demonstrating that each element was, independently, known in the prior art.** … [Rather], it can be **important to identify a reason that would have prompted a person of ordinary skill in the relevant art to combine the [prior art] elements in the manner claimed**." *KSR*, 82 USPQ2d at 1389.

It is fundamental to a proper rejection of claims under 35 U.S.C. § 103 that an examiner must present a convincing line of reasoning supporting the rejection. MPEP 2144 ("Sources of Rationale Supporting a Rejection Under 35 U.S.C. 103"), citing *Ex parte Clapp*, 227 USPQ 972 (Bd. Pat. App. & Inter. 1985). The Supreme Court in *KSR* affirmed the validity of such approach, stating that "**there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.**" *KSR*, 82 USPQ2d at 1396.

In *KSR*, the Supreme Court further confirmed that **references that teach away from the invention are evidence of the non-obviousness** of a claimed invention, (*KSR*, 82 USPQ2d at 1395, 1399) and reaffirmed the principle that a factfinder judging patentability "should be aware, of course, of the distortion caused by hindsight bias and must be cautious of arguments reliant upon *ex post* reasoning."

Following *KSR*, the Federal Circuit held that although "rigid" application of the "teaching, suggestion, or motivation" ("TSM") test for obviousness is improper, **application of a flexible TSM test remains the primary guarantee against improper "hindsight" analysis**, because a flexibly applied TSM test ensures that the obviousness analysis proceeds on the basis of evidence in existence before time the application was filed, as required by 35 U.S.C. §103. *Ortho-McNeil Pharm. Inc. v. Mylan Labs., Inc.*, 520 F3d 1358, 86 USPQ2d 1196, 1201-02 (Fed. Cir. 2008)

An obviousness rejection must be premised on art reasonably available to the applicant. "In order to rely on a reference as a basis for rejection of an applicant's invention, the **reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem** with which the inventor was concerned." *In re Oetiker*, 977 F.2d 1443, 1446, 24 USPQ2d 1443, 1445 (Fed. Cir. 1992); *see also In re Deminski*, 796 F.2d 436, 442, 230 USPQ 313, 315 (Fed. Cir. 1986); MPEP 2141.01(a). The Court of Customs and Patent Appeals has explained the policy that reference be available to the inventor as follows:

> In resolving the question of obviousness under 35 USC 103, we presume full knowledge by the inventor of all the prior art in the field of his endeavor. However, with regard to prior art outside the field of his endeavor, we only presume knowledge from those arts reasonably pertinent to the particular problem with which the inventor was involved. ... The rationale behind this rule precluding rejections based on combination of teachings of references from nonanalogous arts is the realization that an inventor could not possibly be aware of every teaching in every art. Thus, we attempt to more closely approximate the reality of the circumstances surrounding the making of an invention by only presuming knowledge by the inventor of prior art in the field of his endeavor and in analogous arts.

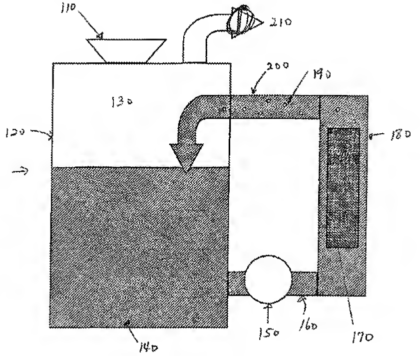
In re Wood and Eversole, 599 F.2d 1032, 202 USPQ 171, 174 (C.C.P.A. 1979) (*citing In re Antle*, 444 F.2d 1168, 1171-72, 170 USPQ 285, 287-88 (C.C.P.A. 1971)).

In a more recent case addressing non-analogous art, the Federal Circuit held that art directed to static or read-only memory circuits with replaceable modules of varying sizes for industrial controllers was **<u>not</u> in the same field of endeavor** as compact modular dynamic memory chips for personal computers. *Wang Labs., Inc. v. Toshiba Corp.*, 993 F.2d 858, 26 USPQ2d 1767 (Fed. Cir. 1993) (upholding validity of patent directed to compact modular memory circuits as non-analogous to, and directed to different problem than, art relating to industrial controller memories having modules of varying sizes).

A suggestion to combine references **cannot require substantial reconstruction or redesign** of such references, **or a change in basic operating principles** of a construction of a reference, to arrive at the claimed invention. *In re Ratti*, 270 F.2d 810, 123 USPQ 349, 352 (C.C.P.A. 1959).

2. *Disclosure of Amendola*

Amendola discloses a system for the storage and controlled release of hydrogen utilizing a liquid such as a borohydride (e.g., $NaBH_4$) solution and a catalyst. One embodiment shown in FIGS. 8A-8B of Amendola includes a system devoid of moving parts in which pressure equalization between a reservoir and a reaction chamber is used to regulate hydrogen generation. (See Amendola, col. 13, lines 41-61.[1]) Another embodiment shown in Amendola FIG. 9 (reproduced below) uses a pump 150 to draw $NaBH_4$ solution from the bottom of a reservoir 120 through a



[1] "As illustrated by FIGS. 8A and 8B, one embodiment of the present invention 10 has no moving parts and **uses pressure equalization to move $NaBH_4$ solution from a reservoir 30 through a tube 50 connecting the bottom of the reservoir into a reaction chamber** 70 h a hydrogen generation catalyst system 80. The reservoir is filled through a re-sealable air tight opening 20, and pressure in the reservoir 30 and reaction chamber 70 can be equalized through connecting tube 65 and control valve 60. When the $NaBH_4$ solution level in the reaction chamber reaches the level of the hydrogen generation catalyst system 80, hydrogen is generated. The hydrogen generation catalyst system 80 includes a tube made out of stainless steel screen, which contains the hydrogen generation catalyst. **While hydrogen is being generated, pressure differences will force $NaBH_4$ solution away from the catalyst tube and stop hydrogen generation**, as shown in FIG. 8B. **When a sufficient amount of hydrogen has been consumed through control** valve **90, the pressure drop once again allows $NaBH_4$ solution to contact the catalyst**, as shown in FIG. 8A. This compact, self-regulating design requires no external power source." (Amendola, col. 13, lines 41-61.)

reaction chamber 180 having a catalyst 170 that promotes release of hydrogen gas from the $NaBH_4$ solution. A tube 200 disposed downstream of the catalyst 170 returns the partially depleted $NaBH_4$ solution together with hydrogen gas 190 to the reservoir 120. Upon return to the reservoir, the $NaBH_4$ liquid solution 140 falls to the bottom of the reservoir 120, while the lighter hydrogen gas 190 collects in the "head space 130, which acts as a storage buffer for [the] hydrogen gas." Flow of hydrogen gas 190 from the head space 130 to a downstream element is controlled by a control valve 210.

Amendola teaches that the pump 150 is controlled responsive to pressure in head space 130. See Amendola, col. 14, lines 11-14:

> Above a certain pressure in head space 130, the pump 150 can reverse direction to drain the catalyst chamber and thereby stop hydrogen production. The pump 150 then shuts off. When the hydrogen pressure drops below a certain predetermined point in head space 130, the pump 150 turns back on in the forward direction to refill reaction chamber 180, generate additional hydrogen gas and replenish hydrogen pressures.

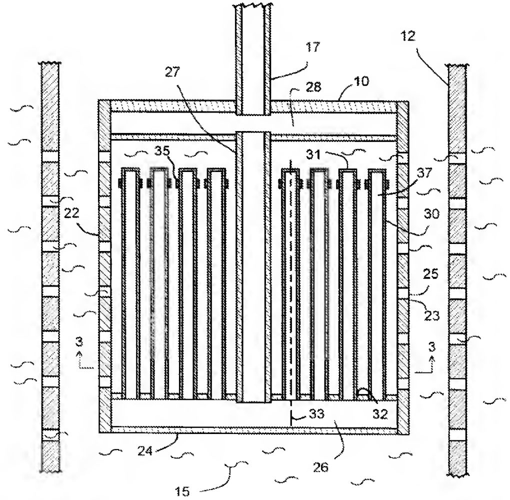
In another embodiment (e.g., at col. 14, lines 29-51), Amendola discloses the use of a flexible piece of stainless steel tubing connected and a pump connected between a supply reservoir and a waste reservoir. The stainless steel tubing is filled with catalyst material retained by mesh at both ends. Hydrogen production by controlled via the pump, which controls flow of metal hydride solution through the flexible tubing into the waste reservoir. Hydrogen may be stored in the waste reservoir or a separate storage tank. To adjust the amount of catalyst use, Amendola teaches that "any appropriate length of tubing can be used, and the tubing can be coiled… to maximize use of space."

Nothing in Amendola discloses any "shell and tube"-type exchanger.

3. Disclosure of Kuespert

Kuespert discloses a gas recovery device adapted to strip gas (e.g., natural gas) from a gas-containing liquid such as brine in a subterranean geological formation, without requiring pumping of gas-bearing water to the surface according to traditional techniques. Kuespert's

device is deployed by insertion into a well casing 12 having holes defined therein to admit gas-containing brine. Referring generally to Kuespert Figure 2 (reproduced below) and column 4, lines 5-67, an optional shell 33 (see col. 8, lines 42-50, referring to possible omission of shell) defining multiple perforations 25 therein may be provided to shield internal components while permitting gas-bearing brine to flow through the walls 23 of the shell 33. Multiple gas permeable but liquid impermeable "permeation tubes" 31 are disposed within the shell and extend upward from a wall of a lower plenum 26. A central transfer pipe 27 connects the lower plenum with an optional intermediate storage chamber 28 where gas collects prior to discharge up the well shaft through discharge pipe 17.



The following excerpts from Kuespert describe how solids such as dirt, clay, and/or precipitated minerals entrained in subterranean brine can detrimentally interfere with transmembrane gas

flow, such that tube flexure and tube spacers may be advantageously used to facilitate beneficial agitation of brine surrounding the tubes.

> **Importantly, each permeation unit is physically affixed to the plenum, and thus, to the shell at only one extremity 32** and the remainder of the elongated permeation unit is free of attachment to the shell. This feature coupled with selection of structurally compatible materials and dimensions of the permeation units, advantageously **permits the tubes to flex** slightly along the axis of tube elongation 33 (FIG. 2). As will be more fully described below, the **ability of the tubes to flex** enables them to deflect radially from the axis of elongation to **provide a beneficial agitation of the brine surrounding the tubes.**

(Kuespert, col. 5, lines 28-38.)

> Solid particles, such as dirt, clay and/or precipitated minerals, may be entrained in the subterranean brine. As gas permeates the membranes, these solids can interfere with transmembrane gas flow by clinging to the outer surfaces of the tubes. The **motion of the flexible tubes causes them to jostle and brush against each other. This helps to clean solids from the outside of the tubes** to a larger extent than would occur if the tubes were stationary.

(Kuespert, col. 7, lines 40-47.)

> A **spacer 35 can be optionally affixed to protrude radially outward from the outer surface of at least one permeation unit tube** to limit the radial deflection so that the tubes remain at least the minimum spacing dimension x apart over the major fraction of their lengths. Preferably a plurality of permeation units will have spacers. The spacers reinforce the tubes at points of mutual contact, thereby diminishing the destructive effect of repeated collisions between tubes and extending tube life. They also may reduce the likelihood that tubes will become entangled. The spacers can be deployed at any axial position along the tubes. Preferably the spacers should be placed in the region from mid-length to the free end 31 of the tubes. Multiple spacers can be placed on each tube. **The spacers can be separate ring-shaped pieces that are mechanically attached to the tubes, or they can be an integral part of the tube itself.** For example, the permeation tubes can have an outer corrugated axial profile, the peaks of which function as spacers.

(Kuespert, col. 5, lines 48-65.)

With respect to **materials and sizing of the permeation units** 31, Kuespert states:

> Particularly preferred for the permeation units of this invention are tubes of expanded polytetrafluoroethylene ("ePTFE"). This material is polytetrafluoroethylene in a microporous form initially developed by W. L. Gore and Associates, Elkton, Md. under the tradename "Goretex". Tubing of ePTFE is commercially available. Preferably **the outer diameter of the tubes should be in the range of about 1/8 inch (about 3 mm) to about 1/2 inch (about 13**

mm), and more preferably 1/4 inch (about 6 mm) to 1/2 inch (about 13 mm). Preferred wall thickness of the tubes is in the range of about 1/16 inch (about 1.6 mm) to about 3/16 inch (about.4.8 mm).

(Kuespert, col. 6, line 58 – col. 7, line 1.)

Kuespert provides no other guidance with respect to permeation tube sizing other than to state the wall thickness range of 3 to 13 mm, more preferably 6 to 13 mm.

4. Disclosure of Nemser

Nemser discloses the use of a gas-permeable but liquid impermeable hollow fibers for gasifying or degasifying a liquid. Perforated hollow fibers are coated with perfluoro-2,2-dimethyl-1,3-dioxole ("PDD"). Referring to Nemser Figure 6, multiple permeable hollow fibers are incorporated into a shell-and-tube-type permeator module 60 having a plurality of hollow membrane units 62 spanning between first and second tube sheets 66, 67 to connect a first plenum 61 and second plenum 63 along the tube side of the permeator 60. The membrane units 62 extend through a shell side cavity 64 disposed between the tube sheets 66, 67. The tube side first plenum 61 and second plenum 63 have associated therewith an first fluid inlet port 71 and a first fluid outlet port 73, respectively. The shell side cavity 64 has a second fluid inlet port 73 and a second fluid outlet port 74. One or more baffles 76 may be provided within the shell side cavity 64.

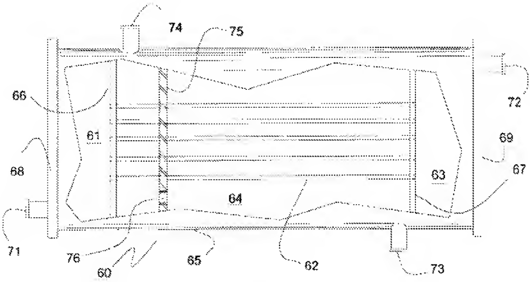


Fig. 6

Nemser describes use of the apparatus of Figure 6 as follows:

> In use, a first fluid, for example a gas mixture including a permeating gaseous component, can be caused to flow through the tube side. A source of the gas mixture is connected to first fluid inlet port and the gas mixture is permitted to enter inlet plenum 61, pass through the interior of hollow fibers 62, discharge to outlet plenum 63 and exhaust through first fluid outlet port 72 to a collection reservoir. Second fluid can be introduced through second fluid inlet port 73 and pumped through the shell side cavity around the membrane units and through the baffle openings to ultimately reach second fluid outlet port 74 for collection.

(Nemser, col. 9, lines 36-63.)

Nemser's apparatus 60 thus constitutes a flow-through apparatus on both the bore and shell sides thereof.

With respect to contemplated end uses, Nemser refers to the following:

> "... purifying drinking water through ozonolysis, oxygenating bioreactors and restoring oxygen to blood; oxidizing volatile organic compounds in water; adding gaseous reactants to liquid chemical reactions and supplying oxygen and removing volatile pollutants from waste water;' (col. 1, lines 13-18) and
>
> "ozonating sanitary or industrial waste water to remove undesirable microorganisms and organics; remediation by oxygenating natural streams, ponds and waterways depleted of oxygen by industrial waste contamination or farm land run off; oxygenating water in tanks and ponds for purposes of aquaculture; and depleting oxygen in reactors for anaerobic reactions or boiler water feed ... [and] use in bioreactor systems ... [including] oxygenation of blood and the oxygenation of cell culture media" (col. 6, lines 15-31).

Nothing in Nemser suggests the use of porous hollow fibers for hydrogen generation.

With respect to fiber sizing, Nemser discloses use of hollow fibers having outer diameters of 240 μm, 660 μm, and 800 μm (Nemser, col. 10, lines 31-40).

Nemser teaches away from the use of gas permeable polymer membranes generally, stating:

> Gas permeable polymer membranes might present an attractive technology for conducting mass transfer of gases. U.S. Pat. No. 5,051,114 to S. Nemser, issued Sep. 24, 1991, which is incorporated herein by reference, teaches the use of permeable polymer membranes for enriching or separating a gaseous organic

> compound in a gas or a gas mixture. However, **most gas permeable membranes are not suited to transporting gas to or from a liquid**. If the membrane is perforated or porous, gas can pass through the membrane too quickly and bubble into the liquid with the attendant disadvantages noted above. Also, the liquid can leak through the perforations or pores to contaminate the gas. Additionally the liquid and/or solids which might be present can clog the pores to reduce gas transfer.
>
> **Most nonporous polymer permeable membranes present too great a barrier to gas transfer for practical gasifying or degasifying a liquid**. Low free volume gas permeable membranes of nonporous polymers have wholly inadequate gas permeability. Other known high free volume, nonporous polymer, gas permeable membranes are not acceptable for transporting gas to or from a liquid.

(Nemser, col. 1, line 50-col. 2, line 3.)

5. Disclosure of Hockaday

Hockaday discloses the use of sputter-deposited and other metal coatings on porous dielectric substrates for use in fuel cells (e.g., Hockaday, ¶ [0020]) and fuel cells incorporating such materials. .

6. Patentable Distinctions of Applicants' Claims Over the Cited Art

Pending and non-withdrawn claims 1-14, 16-39, 41-47, 49, and 50 include one independent claim, namely, claim 1. Pending claim 1 is reproduced below.

> 1. A storage and dispensing system for storing and dispensing a target gas, comprising:
>
> (a) a housing for containment of carrier material for the target gas, said housing comprising a gas collection compartment and a gas storage compartment, and being adapted to hold a volume of said carrier material in isolation from an exterior environment of the housing;
>
> (b) a plurality of microtubular elements disposed in said housing i) having an outer diameter in a range of from 10 micrometers to 1 millimeter, ii) one or more open ends in fluid communication with either the gas collection compartment or the gas storage compartment and iii) extending from said compartment with which it is in fluid communication and into the other compartment, wherein each of said microtubular elements comprises a tubular wall defining a bore side and a shell side,

and wherein the bore side of each of said microtubular elements is sealed from the shell side thereof;

(c) a seal which, together with the tubular walls, sealingly isolates the gas collection compartment from the gas storage compartment; and

(d) a carrier material for storing said target gas, wherein said carrier material is disposed in said gas storage compartment and stored in said housing in isolation from the exterior environment of said housing, and wherein the gas storage compartment is at either the bore sides or the shell sides of said microtubular elements.

As dependent claims inherently include all the features of the claims on which they depend pursuant to 35 U.S.C. 112, claims 2-14, 16-39, 41-47, 49, and 50 (which all depend, whether directly or indirectly, from claim 1) likewise include all the features of claim 1.

a) Kuespert is Not Properly Citable in an Obviousness Rejection Against Applicants' Claims, as it Constitutes Non-Analogous Art

In the April 9, 2008 Office Action (i.e., at pages 3-4 thereof), the examiner admits that Amendola fails to teach numerous elements of independent claim 1. In an attempt to remedy some (but not all) of the deficiencies in Amendola's disclosure, the examiner alleges that it would be obvious to combine Amendola with Kuespert on the basis that "Kuespert ... is relevant to the Amendola reference and the applicant's field of endeavor because it solve [sic, *solves*] the same problem of separating gas from a liquid carrier material." (April 9, 2008 Office Action, page 6, final sentence.) The foregoing characterization paints with too broad a brush, as it draws an improper parallel between the disclosure of Kuespert on the one hand, and, on the other hand, the disclosures of Amendola and Applicants. Key aspects of Amendola and Kuespert are compared below.

	Amendola (US 6534033)	**Kuespert** (US 6228146)
Title of the Invention	"System for hydrogen generation"	"Gas recovery device"
Field of the Invention	"The present invention relates to a system for generating hydrogen gas. In particular, the present invention relates to a **hydrogen generation system including a stabilized metal hydride solution and a catalyst system**."	"This invention relates to a membrane separation device for recovering gas from gas-liquid mixtures and solutions. More specifically, it relates to **recovery of natural gas or gaseous mixtures from solutions of gas dissolved in water**."
Problem to be Solved	Providing safe and efficient storage and controllable generation of hydrogen gas	Promoting recovery of natural gas from low yielding and/or partially depleted subterranean wells having gas dissolved in brine (water), without pumping gas-bearing water to the surface.
Technical Solution	A hydrogen generation system including a metal hydride solution **isolated from an ambient environment**, a hydrogen generation catalyst in a reaction chamber to be selectively contacted by the metal hydride, and **a reservoir in which hydrogen gas and reacted metal hydride are separated by gravity** due to their differing densities.	A gas recovery device arranged for immersion in a gas-containing liquid solution (e.g., subterranean brine containing natural gas) **admits such liquid from a surrounding environment** into the device to contact at least one **gas-permeable but liquid-impermeable membrane** of a "permeation unit" **allows passage of gas but blocks passage of liquid to thereby separate gas from the liquid**. From the at least one permeation unit, separated gas flows through a plenum into a gas transfer pipe for transport to the surface of a well.

For sake of further comparison, the instant application states that "[t]he present invention relates to **gas storage and dispensing systems** in general, and more specifically to **hydrogen storage systems** and fuel cell systems with hydrogen storage capacity." (Application, ¶ [0003].)

Applicants do not dispute the fact that Amendola relates to the same technical field of Applicant's endeavor (namely, gas storage and dispensing systems, more specifically relating to hydrogen storage systems). Applicants do dispute, however, the examiner's allegation that Kuespert constitutes art analogous to the present invention.

"In order to rely on a reference as a basis for rejection of an applicant's invention, the **reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to**

the particular problem with which the inventor was concerned." *In re Oetiker*, 977 F.2d 1443, 1446, 24 USPQ2d 1443, 1445 (Fed. Cir. 1992).

Kuespert relates to open-shell systems to admit liquid from a surrounding environment such as a subterranean well and separate natural gas dissolved in liquid water. "Under pressure existing in typical gas-yield formations, the gas is usually dissolved in the liquid and needs to be separated therefrom." (Kuespert, col. 1, lines 24-26.) Kuespert's device is specifically designed to avoid pumping of gas-bearing water to the surface, which consumes large quantities of energy and requires disposal of the resulting waste water. (Kuespert, col. 1, lines 27-33.) Systems according to Kuespert enable recovery of substantial amounts of natural gas from wells that are "not productive for various reasons, such as the gas concentration mixed with the brine is too low for traditional gas recovery methods to operate economically, the water flow is too great and/or the water pressure is too high." (Kuespert, col. 9, lines 31-36.) Kuespert recognizes that "deep wells and geopressurized wells [can cause] large pressure gradients ... across the membrane" that facilitates transport of gas (together with a lesser quantity of liquid) through a permeation unit. (Kuespert, col. 6, lines 6-9.) Thus, the **basic problem addressed by Kuespert is how to efficiently separate gas dissolved in liquid in a surrounding environment, *in situ* without requiring pumping of gas-bearing liquid to the surface**. As Kuespert inherently involves an open system to admit liquid from a surrounding environment, **Kuespert is further concerned with addressing the problem of avoiding interference by solids** (e.g., dirt, clay, precipitated minerals) **with transmembrane gas flow**. (Kuespert, col. 7, lines 40-47; and col. 5, lines 28-65.)

As indicated previously, Applicants' system relates to the "field of endeavor" of **gas storage and dispensing systems** in general, and more specifically to **hydrogen storage systems** and fuel cell systems with hydrogen storage capacity. Nothing in Kuespert's open system is concerned with gas storage; rather, Kuespert relates to the "field of endeavor" of "recovering gas from gas-liquid mixtures and solutions" and "[m]ore specifically, ... recovery of natural gas or gaseous mixtures from solutions of gas dissolved in water."

The specific problem encountered by Applicants is **controlled generation of hydrogen from a closed system** including a carrier material maintained in isolation from an exterior environment.

This contrasts with Kuespert's problem of **extracting dissolved natural gas** from brine using a **device that is open to a surrounding environment**. Kuespert's problem of minimizing interference by solids – as inherent to a system open to subterranean brine – is further not encountered in Applicant's system.

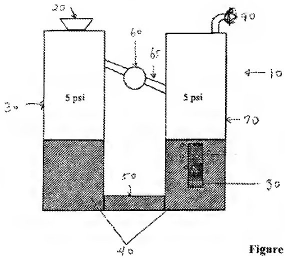
Because Applicants' invention is not in the same field of endeavor as Kuespert, and is directed to a different problem than Kuespert, the Kuespert patent constitutes non-analogous art that may not be properly combined with Amendola. To the extent that the examiner seeks to maintain a more expansive view of the field of endeavor and specific technical problems of Kuespert, the examiner is invited to review the Federal Circuit's opinion in *Wang Labs., Inc. v. Toshiba Corp.*, 993 F.2d 858, 26 USPQ2d 1767 (Fed. Cir. 1993) (upholding validity of patent directed to compact modular memory circuits as non-analogous to, and directed to different problem than, art relating to industrial controller memories having modules of varying sizes).

b) The Hypothetical Combination of Kuespert With Amendola Would Impermissibly Require Substantial Reconstruction or Redesign, or Change in Basic Operating Principles, of Amendola

In the April 9, 2008 Office Action (*i.e.*, at page 6 thereof) the examiner alleges that it would be obvious to combine Kuespert with Amendola "in order to [increase] efficiency of gas generation by increasing the surface area of the gas/liquid interface." Such reason lacks merit, in view of the well-settled principle that a suggestion to combine references **cannot require substantial reconstruction or redesign** of such references, **or a change in basic operating principles** of a construction of a reference, to arrive at the claimed invention. *In re Ratti*, 270 F.2d 810, 123 USPQ 349, 352 (C.C.P.A. 1959).

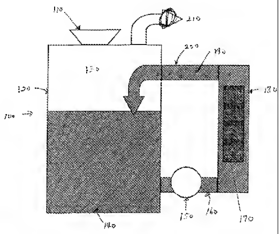
Amendola is directed to a hydrogen generation system including a metal hydride solution isolated from an ambient environment, a hydrogen generation catalyst arranged in a reaction chamber to be selectively contacted by the metal hydride solution, and **a reservoir in which hydrogen gas and reacted metal hydride are separated by gravity** due to their differing densities. See, e.g., Amendola Figures 8A and 9, as reproduced below.

Figure 8A



Figure

Figure 9



Referring to Amendola Figures 8A and 9, hydrogen gas is separated from metal hydride solution by gravity in chambers 70 and 120 (with the latter chamber 120 including a head space portion 130), and such hydrogen gas is ultimately removed via control valves 90 and 210.

The examiner's proposal to modify the Amendola hydrogen generation system – namely *"to include [1] a plurality of microtubular elements disposed in the housing, having one or more open ends in fluid communication with either the gas collection compartment or the gas storage compartment and extending from the compartment with which it is in communication and into the other compartment; wherein each of the microtubular elements comprises a tubular wall permeable to a target gas and defining a bore side and a shell side, and wherein the bore side of each microtubular element is sealed from the shell side thereof; [2] a seal, which together with the tubular walls, sealingly isolates the gas collection compartment from the gas storage compartment; [and 3] a carrier material that is disposed in and stored in the housing at either the bore sides or the shell sides of the microtubular elements*" [April 9, 2008 Office Action, pages 5-6] – **represents a substantial reconstruction or redesign** of Amendola's apparatus, **and** a **change in basic operating principles** of Amendola's apparatus.

Amendola relies upon **gravitational separation** of hydrogen gas from metal hydride solution due to differences in the densities thereof. Kuespert teaches **pressure-driven separation** of gas from liquid via a permeable membrane. This represents a difference in operating principles for

between Amendola and Kuespert. Hypothetical addition of a porous barrier to Amendola would also necessarily impose a significant pressure drop that would impede hydrogen release, and would require presence of a pressure gradient sufficient to cause hydrogen gas to flow therethrough.

The hypothetical modification of Amendola to include porous permeation elements as disclosed by Kuespert would further require a **substantial reconstruction or redesign** of Amendola's gas generation system. For example:

- How would the hypothetical "seal [that] sealingly isolates the gas collection compartment from the gas storage compartment" be arranged relative to the head space portion 130 of the reservoir 120, and relative to the connection between recirculation tube 200 and the upper portion of reservoir 120, as depicted in Amendola Figure 9?
- Where would the hypothetical "plurality of microtubular elements disposed in the housing" be arranged relative to Amendola's reservoir 120, head space portion 130, and re-sealable opening 110?
- If reverse flow through Amendola's circulation loop between the reservoir 120 and reaction chamber 180 (including tubes 160 and 200) were not interruptible by the presence of head space 130, then how would Amendola implement the safety function of reversing the pump direction "to drain the catalyst chamber and thereby stop hydrogen production?" (Amendola, col. 14, lines 9-15.)

Addressing these and other similar issues would involve **more than trivial combination** of the references; **rather, <u>substantial reconstruction or redesign would be required</u>**. Given the disparate nature and operating principles of devices according to Amendola and Kuespert, the hypothetical combination of the two would produce a seeming inoperative device – such that the references **teach away from the combination** and cannot serve as predicates for a *prima facie* case of obviousness.[2]

[2] See, e.g., *McGinley v. Franklin Sports, Inc.*, 262 F.3d 1339, 60 USPQ2d 1001, 1010 (Fed. Cir. 2001); *Tec Air, Inc. v. Denso Mfg. Mich. Inc.*, 192 F.3d 1353, 52 USPQ2d 1294, 1298 (Fed. Cir. 1999) (proposed combination of references that would be inoperable for intended purpose supports teaching away from combination); *In re Gordon*, 733 F.2d 900, 902, 221 USPQ 1125, 1127 (Fed. Cir. 1984) (inoperable modification teaches away).; *In re Sponnoble*, 405 F.2d 578, 587, 160 USPQ 237, 244 (C.C.P.A. 1969) (references teach away from combination if combination produces seemingly inoperative device)

c) Application of a Flexible "Teaching, Suggestion, Motivation" Test Demonstrates No Reason to Combine Kuespert with Amendola

The Federal Circuit recently re-validated a flexible "teaching, suggestion, motivation" test as the primary guarantee against improper "hindsight" analysis. *See Ortho-McNeil Pharm. Inc. v. Mylan Labs., Inc.*, 520 F3d 1358, 86 USPQ2d 1196, 1201-02 (Fed. Cir. 2008). The examiner has pointed to nothing in the art that would motivate one skilled in the art to combine Kuespert with Amendola. Rather, there exist good reasons why one skilled in the art would not look to Kuespert to enhance Amendola's hydrogen generation apparatus.

First, the hypothetical addition of microtubular elements and a seal to Amendola's system would necessarily increase its capital cost and complexity (because additional components – e.g., the tubes – would be added), and increase susceptibility to operational problems (because more components with additional failure modes would be present).

Second, the hypothetical addition of a permeable membrane to Amendola to provide gas/liquid separation utility would necessarily impose a pressure drop that would impede release of hydrogen to a downstream process. With reference to Figure 9, Amendola states that "[t]his design has very rapid response to hydrogen requirement." (Amendola, col. 14, lines 9-10.) Hypothetical addition of a permeable membrane to Amendola's apparatus would inherently slow the system's response to hydrogen demand, because sufficient pressure would need to be generated to overcome the pressure drop created by such membrane.

Third, Kuespert is directed to an open system that necessarily admits liquid from a surrounding environment, whereas Amendola is directed to a closed system that isolates metal hydride solution from an ambient environment.

Accordingly, since the Amendola system already effects a simple and efficient separation of gas from liquid, there is no reason to modify it in any manner that would (1) increase its capital cost, (2) increase its complexity, and/or (3) interfere with the arrangement taught by Amendola of a bulk liquid volume in direct contact with a bulk gas volume to effect gravitational (density-based) separation – particularly when it is not apparent how Kuespert's multiple tube array could be structurally integrated with Amendola's apparatus.

As any suggestion or motivation to combine Kuespert and Amendola is wholly lacking, it is apparent that the examiner has combined such art to reconstruct Applicant's invention with improper hindsight bias obtained by review of the instant application. The Federal Circuit has repeatedly cautioned against use of hindsight reconstruction to support an obviousness rejection; for example:

> "To imbue one of ordinary skill in the art with the knowledge of the invention in suit, when no prior art reference or references of record convey or suggest that knowledge, is to fall victim to the insidious effect of a hindsight syndrome wherein that which only the inventor taught is used against its teacher."

W.L. Gore & Assocs. v. Garlock, Inc., 721 F.2d 1540, 1553, 220 USPQ 303, 312-13 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984); *see also Ortho-McNeil Pharm. Inc. v. Mylan Labs., Inc.*, 520 F3d 1358, 86 USPQ2d 1196, 1201-02 (Fed. Cir. 2008).

d) No Motivation Exists to Combine Nemser With Amendola and Kuespert, Particularly Since Kuespert Teaches Away From Microtubular Elements

In the April 9, 2008 Office Action (*i.e.*, at page 7 thereof), the examiner admits that the hypothetical combination of Amendola and Kuespert fails to teach use of "microtubular elements that have an outer diameter in a range of from 10 micrometer to 1 millimeter, wherein the tubular walls of the microtubular elements comprise a first layer of structural material that is gas and liquid permeable and a second layer that is gas permeable but liquid impermeable." In an attempt to remedy the foregoing the deficiencies in the hypothetical Amendola / Kuespert combination, the examiner alleges that it would be obvious to further combine Amendola / Kuespert with Nemser to substitute microtubular elements for Kuespert's tubular elements, allegedly "in order to [1] maximize the rate of gas transmission through the membrane; [2] maximize gas flux; and [3] increase the surface area available for gas transfer by utilizing a larger number of microtubular elements with a smaller diameter." (April 9, 2008 Office Action, page 7.) Even if there existed good reason to combine Amendola and Kuespert (which reason is lacking), the hypothetical further combination of Nemser with Amendola / Kuespert is not supportable.

Nemser discloses use of hollow fibers having outer diameters of 240 μm, 660 μm, and 800 μm (Nemser, col. 10, lines 31-40). Kuespert's minimum tube outer diameter – namely, 3 millimeters

– is **nearly four times larger** than the largest tube outer diameter disclosed by Nemser. Nothing in Kuespert remotely suggests that smaller tubes should be used. And as indicated previously, nothing in Amendola suggests that any permeable tubes whatsoever should be used.

Kuespert further discloses that "**minimum spacing**" **should be maintained between tubes**, such as with spacers 35, such as to enable elimination of solids (e.g., dirt, clay, precipitated minerals) from the outside of the tubes that would otherwise interfere with transmembrane gas flow. Maintenance of tube spacing and allowing tube flexure according to Kuespert facilitates beneficial agitation of brine surrounding the tubes to diminish accumulation of solids. Hypothetical substitution of "a larger number of (Nemser's) microtubular elements with smaller diameter" (Office Action, page 7) for a smaller number of Kuespert's tubes having outer diameter of at least 3 millimeters would **directly contradict** Kuespert's teaching that minimum tube spacing should be maintained, and interfere with Kuespert's critical solid elimination function.

The foregoing demonstrates that Kuespert **teaches away** from the use of microtubular elements as disclosed by Nemser. The examiner has ignored the foregoing portions of Kuespert that teach away from the hypothetical combination with Nemser, which contradicts the rule that "prior art must be considered as a whole" including "portions that teach away from the invention under consideration." *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984).

Once again, it is apparent that the examiner has engaged in impermissible hindsight reconstruction in combining Nemser with Amendola and Kuespert. Such hindsight reconstruction is not a proper basis for supporting an obviousness rejection under 35 U.S.C. 103.

Applicants have therefore been demonstrated that the proposed combinations of Amendola and Kuespert, and of Nemser with Amendola and Kuespert, are legally untenable. As a result, no proper basis exists for the rejection of claim 1 (and all claims depending therefrom) under 35 U.S.C. 103. Accordingly, withdrawal of the claim rejections under 35 U.S.C. 103 is warranted, and is respectfully requested.

CONCLUSION

Based on the foregoing, all of Applicants' pending claims are patentably distinguished over the art, and in form and condition for allowance. The examiner is requested to favorably consider the foregoing, and to responsively issue a Notice of Allowance. If any issues require further resolution, the examiner is requested to contact the undersigned attorney at (919) 419-9350 to discuss same.

Respectfully submitted,

/vincent k. gustafson/

Vincent K. Gustafson
Reg. No. 46,182
Attorney for Applicants

INTELLECTUAL PROPERTY/
TECHNOLOGY LAW
Phone: (919) 419-9350
Fax: (919) 419-9354
Attorney File No.: 4172-121

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